SELF-PROPELLED WATERCRAFT

Background

Self-propelled watercraft, such as kayaks, open and decked canoes, etc., whether designed for use in whitewater, the sea, or flat water, may includes various items of outfitting configured to improve the comfort, fit, performance and safety of the watercraft. For example, a whitewater kayak may include a contoured seat to position and support the user within the cockpit, a seat support to support the seat in the cockpit and to provide structural support to the hull in the cockpit region of the watercraft, pillars to support the deck and hull in the bow and stern regions of the watercraft, and various types of thigh braces, foot braces and hip braces against which the user may exert force to control the boat, and which help to hold the user in the boat.

These and other items of outfitting are generally secured to the watercraft in some manner to hold them in the correct location within the watercraft, and to prevent them from falling out of the watercraft during transport, a capsize, etc. In plastic watercraft, outfitting is typically attached to the watercraft by forming a hole in or through the deck or hull, and then attaching the item of outfitting to the watercraft with a bolt or other fastener. However, this method of attaching outfitting may pose various problems. For example, because a seat support is typically attached to the bottom of a watercraft, bolting the item of outfitting to the watercraft may cause a bolt head or nut to protrude into the water past the plane of the hull, and thus may affect the performance of the watercraft. Furthermore, such a hole may present a risk of water leakage during use of the watercraft. For these reasons, items of outfitting such as seats, seat supports, etc.

have typically been designed to include attachment features that can be attached to the sides of the hull or the deck of the watercraft.

Summary

One embodiment provides a self-propelled watercraft, wherein the watercraft includes a body made at least partially of a polymer material, the body including a surface and at least one of a deck and a hull, and wherein the watercraft includes an item of outfitting welded to the surface of the body.

Another embodiment provides a self-propelled watercraft, wherein the watercraft includes a body made at least partially of a weldable polymer material, and wherein the body includes an interior surface, an item of outfitting welded to the interior surface of the body, and an electrical conductor disposed at least partially between the surface of the body and the item of outfitting.

Another embodiment provides a method of manufacturing a self-propelled watercraft, wherein the watercraft includes a body made at least partially of a weldable polymer material and also includes an item of outfitting coupled to the body, wherein the method includes placing a weldable intermediate structure between the item of outfitting and the body such that the weldable intermediate is in contact with a surface of the item of outfitting and a surface of the body, and heating the weldable intermediate structure to weld the weldable intermediate structure to the item of outfitting and the body.

Yet another embodiment provides a method of manufacturing a self-propelled watercraft, wherein the watercraft includes a body made at least partially of a weldable polymer material, and also includes an item of outfitting made of the weldable material

and coupled to the body. The method includes placing an electrically conductive element between a surface of the body and a surface of the item of outfitting, wherein the electrically conductive element is at least partially covered by a layer of the weldable material, and heating the electrically conductive element by passing an electrical current through the electrically conductive element to cause the layer of the weldable material at least partially covering the electrically conductive element to weld to the surface of the item of outfitting to the surface of the body of the watercraft.

Brief Description of the Figures

Fig. 1 is a view of a first embodiment of a self-propelled watercraft.

Fig. 2 is an exploded view of the cockpit region of the embodiment of Fig. 1, showing a weldable intermediate positioned between the seat support and the watercraft hull.

Fig. 3 is a sectional view of the hull, seat support and weldable intermediate of the embodiment of Fig. 1.

Fig. 4 is a flow diagram of a method of making a self-propelled watercraft according to another embodiment of the present invention.

Detailed Description of the Depicted Embodiments

Fig. 1 shows, generally at 10, a first embodiment of a self-propelled watercraft according to the present invention, in the form of a whitewater kayak. Watercraft 10 includes a hull 12, and a deck 14 substantially covering the hull to form an enclosed body. Deck 14 includes a cockpit 16 configured to accommodate a user. Watercraft 10 also includes a seat 18 positioned within the cockpit, and a seat support, such as seat

support 20, on which seat 18 rests. Seat support 20 both supports seat 18 within cockpit 16, and also provides structural support for hull 12 to help prevent hull 12 from collapsing if watercraft 10 is pinned against a rock or other object in a heavy current.

Watercraft 10 may also include other items of outfitting. For example, watercraft 10 may include a back support 22, one or more hip pads 24 supported by hip braces 26, thigh braces 28, foot braces (not shown), bulkheads (not shown), etc. Hip pads 24, thigh braces 28, back support 22, seat 18 or any other suitable item of outfitting may be connected to a fluid-activated fitting system controlled by a squeeze bulb 30, or other suitable pump and release valve system. Examples of suitable fluid fitting systems are disclosed in U.S. Patent Application Serial No. 10/215,361, filed August 7, 2002, and U.S. Patent Application Serial No. 10/726,969, filed December 2, 2003, the disclosures of which are hereby incorporated by reference. Also, watercraft 10 may include pillars, such as those shown at 32 in Fig. 2, that extend from hull 12 to deck 14 in bow and stern regions of the watercraft to help prevent the deck from collapsing under stress caused by water pressure against the deck and/or hull.

Conventionally, each of these items of outfitting is attached to the hull or deck via one or more fasteners, or in an indirect manner. For example, in some watercraft, the seat support is not attached directly to the hull or deck, but instead includes fore and aft extensions that extend beneath the bow and stern pillars such that the seat support is held in place by the pillars. In these watercraft, the seat is typically not mounted directly to the seat support. Instead, the seat includes upturned sides configured to be connected to the side of the hull via fasteners to ensure the seat does not shift within the cockpit during

use. In other prior watercraft, the seat support is bolted directly to the bottom of the watercraft, either via a hole formed through the hull, or via a threaded insert that is insert-molded into the hull. Adhesives have also been used to attach some items of outfitting to the inside of watercraft, such as closed-cell foam pads that pad the surfaces of hip braces, thigh braces, seats, etc.

In contrast, seat support 20 is attached to hull 12 via welding. Welding is the joining or bonding of metal or thermoplastic surfaces by application of temperatures high enough to melt the materials so that they fuse to a permanent union on cooling. On a molecular level, the polymer chains within the thermoplastic melt and flow together during the welding process. Upon cooling, the polymer chains from one part are fused with chains from the other part to which it is welded. The result is the formation of an extremely strong bond between the welded parts. In contrast, adhesives cause bonding only by surface interactions between the adhesive and each individual part, rather than by the commingling of polymer chains from the parts themselves in a melted phase. Therefore, adhesives may not provide enough bonding strength for adhering items of outfitting such as seat support 20 to the surface of hull 12.

Welding seat support 20 to hull 12 may offer several advantages over conventional methods of attaching outfitting to a watercraft. For example, welding seat support 20 to hull 12 may greatly increase the stiffness of the hull compared to conventional watercraft in which the seat support is bolted or indirectly attached to the hull. This is because the welded seat support is attached firmly to the hull along its entire length, and therefore does not separate from the hull at any point along its length when the hull is under stress.

This may help to prevent the hull from deforming under stress. Furthermore, welding seat support 20 to hull 12 also may allow the seat to be attached directly to the seat support, rather than to the interior sides of watercraft 10. This is because the weld holds seat support 20 firmly in its correct position within cockpit 16, and does not allow the seat support, and therefore the seat, to shift within the cockpit.

Hull 12 and seat support 20 may be made from any suitable weldable materials. One example of a suitable material is the weldable thermoplastic material polyethylene. Other examples include, but are not limited to, polypropylene.

Hull 12 and/or seat support 20 may also be made from a composite material. One example of a suitable composite material is TWINTEX, manufactured by the Saint-Gobain Vetrotex Corp., which includes a fiberous cloth disposed within a polyethylene matrix. This material is typically molded via thermoforming, in which a sheet of the material is heated and pressed into a desired shape within a mold, rather than via rotational molding, in which a polymer powder is molded in a heated mold while the mold is rotated. The use of welding to attach seat support 20 to hull 12 in a watercraft made of a thermoformed, composite thermoplastic material allows the seat support to be strongly attached to the hull without having to insert mold a fastener into the hull (which may be difficult to do when thermoforming a composite material such as TWINTEX), or having to drill or otherwise form a hole through the deck or hull.

Seat support 20 may be welded to hull 12 in any suitable manner. Fig. 2 illustrates structures suitable for performing one method of welding seat support 20 to hull 12. In Fig. 2, a weldable intermediate 40 is disposed between hull 12 and seat support 20.

Weldable intermediate 40 includes an outer portion 42, such as a sheath or coating, made of the same material as hull 12 and seat support 20. The use of a coating made of the same material as the hull and the item of outfitting allows the weldable intermediate to form a strong bond to both the hull and the seat support to thereby weld the seat support to the hull. Alternatively, outer portion 42 may be formed from a different material than hull 12 and/or seat support 20, as long as the material from which outer portion 42 is formed can be welded to the material or materials from which the hull and seat support are made.

Weldable intermediate 40 also includes an electrically conductive core 44. Electrically conductive core 44 may be connected to a power source 46, and current may be run through electrically conductive core 44 to heat the weldable intermediate 40. When the weldable intermediate 40 is in contact with seat support 20 and hull 12, heating the weldable intermediate 40 also heats the surfaces of seat support 20 and of hull 12 to similar temperatures. Weldable polymers typically have particular temperatures or temperature ranges at which welding is able to occur. By contacting the surfaces of seat support 20 and hull 12 to weldable intermediate 40 as the weldable intermediate is heated, the surfaces of the seat support and hull reach a desired welding temperature substantially contemporaneously with the surfaces of weldable intermediate 40, thus allowing welding to take place. After welding has taken place, weldable intermediate may be simply disconnected from power source 46 to complete the welding process.

Weldable intermediate 40 may have any suitable configuration. In the depicted embodiment, weldable intermediate 40 takes the form of a length of cable coated with a

weldable polymer material. The cable extends along one side of seat support 20, then loops around and extends along the other side of the seat support. In this manner, each side of seat support 20 is welded to hull 12, as illustrated in Fig. 3, thus strongly bonding the seat support to the hull. However, weldable intermediate 40 may have any other suitable configuration. For example, weldable intermediate 40 may have a broad, flat, sheet-like configuration that extends substantially the width of seat support 20, or a broad shape with perforations to form a lattice-like or net-like shape.

Likewise, weldable intermediate 40 may be arranged in any suitable pattern between seat support 20 and hull 12 besides that depicted in Fig. 2. For example, a length of weldable intermediate may be run along the center of seat support 20 in addition to along the sides, or in a zig-zag pattern beneath the seat support. It will be appreciated that these alternate constructions and arrangements for weldable intermediate 40 are set forth for the purpose of example, and that weldable intermediate 40 may have any other suitable construction, and any other suitable arrangement between seat support 20 and hull 12.

Any other suitable method of welding besides the use of weldable intermediate 40 may be used to weld seat support 20 to hull 12. Examples of other suitable welding methods include, but are not limited to, extrusion welding, induction welding and injection welding. One example of a suitable injection welding system is that manufactured by Drader Injectiweld of Edmonton, Alberta, Canada. An example of a suitable induction welding system is the EMABOND system manufactured by Ashland Specialty Chemical Company of Ashland, Ohio.

Fig. 4 shows, generally at 100, a method of manufacturing a personal watercraft according to another embodiment. Method 100 includes first placing an item of outfitting into the watercraft at 102, placing a weldable intermediate material between the item of outfitting and the watercraft at 104, and then causing the weldable intermediate to weld to the item of outfitting and the surface of the watercraft at 106, thus welding the item of outfitting to the surface of the watercraft. It will be appreciated that the weldable intermediate may be placed between the item of outfitting and the surface of the watercraft either before causing the weldable intermediate to weld to the item of outfitting and the watercraft, or may be placed between the item of outfitting and watercraft surface during the welding process.

The weldable intermediate may be caused to weld to the item of outfitting in any suitable manner. Generally, the manner in which the item of outfitting is caused to weld to the weldable material varies depending upon the welding method used. For example, where injection welding is used, the weldable material is heated by the welding tool, and the weld is created by a combination of the heated tip of the welding tool and the pressure with which the weldable material is injected into the space between the surface of the watercraft and the item of outfitting. Likewise, where weldable intermediate 40 is used, the weld is caused by running an electrical current through the electrical conductor, causing the conductor to heat the weldable intermediate, the item of outfitting and the surface of the watercraft to cause these structures to weld to one another. Pressure may be applied during these welding processes to help the weld form.

Any suitable item of outfitting besides the seat support may be attached to the watercraft utilizing method 100. For example, many items of outfitting commonly used within the interior of a watercraft or other personal watercraft may be attached to the watercraft utilizing method 100. Examples of such items of outfitting include, but are not limited to, seats, back braces, thigh or knee braces, foot braces, and bulkheads.

Furthermore, method 100 may be used to attach support pillars to the interior of the watercraft. In conventional kayaks and other decked self-propelled watercraft, support pillars, typically made of closed cell foam, are put in the bow and stern regions of the boat to support the deck and/or hull, and to help prevent collapse of the deck and/or hull if the watercraft pins against an object. However, via method 100, pillars (or other support structures) made of a more rigid material, such as polyethylene or polypropylene, may be welded directly to interior surfaces of the hull and deck, thereby forming a stronger and more rigid support for the deck and hull. Such pillars may run either along the long axis of the watercraft, substantially perpendicular to the long axis of the watercraft, or in any other suitable direction to provide a desired amount of reinforcement to the deck and hull.

Furthermore, method 100 may be used to attach various items of outfitting to exterior surfaces of watercraft. For example, many sea kayaks and flat-water watercraft include fittings connected to the bow and deck surfaces that accommodate cords, ropes and/or other features for holding down gear, etc. These types of watercraft also may include mounting features configured to allow the attachment of rudders and other mechanical devices. Such fittings and mounting features may be attached to exterior

surfaces of a watercraft via method 100 without having to drill or otherwise form holes extending through the watercraft deck and/or hull for a bolt or other fastener. As another example, whitewater watercraft often includes such exterior outfitting as grab loops which may be used to rescue other boaters who have capsized and come out of their boats, and rigid bars attached to the bow and stern decks to provide a location at which a line may be attached to the watercraft to extract the watercraft from a pin in heavy current. Any of these outfitting items may likewise be attached according to method 100.

Although the present disclosure includes specific embodiments of watercraft, outfitting for watercraft, and methods of manufacturing watercraft, specific embodiments are not to be considered in a limiting sense, because numerous variations of watercraft and outfitting are possible. The subject matter of the present disclosure includes all novel and nonobvious combinations and subcombinations of the various methods, watercraft, outfitting, and other elements, features, functions, and/or properties disclosed herein. The following claims particularly point out certain combinations and subcombinations regarded as novel and nonobvious. These claims may refer to "an" element or "a first" element or the equivalent thereof. Such claims should be understood to include incorporation of one or more such elements, neither requiring nor excluding two or more such elements. Other combinations and subcombinations of features, functions, elements, and/or properties may be claimed through amendment of the present claims or through presentation of new claims in this or a related application. Such claims, whether broader, narrower, equal, or different in scope to the original claims, also are regarded as included within the subject matter of the present disclosure.